

## The (Only) Ten Truth-Functional Logic Principles You Need To Know (plus two invalid ones!)

Where P and Q are statements, we'll use the following symbols as abbreviations for the following statements:

$\neg P$ : P is not true ('not P')

$P \wedge Q$ : P and Q are both true ('P and Q')

$P \vee Q$ : either P is true or Q is true (or both) ('P or Q')

$P \rightarrow Q$ : if P is true then Q is true ('If P then Q' or 'Q if P' or 'P only if Q')

$\perp$ : contradiction (e.g. both P and  $\neg P$  are true at the same time)

$\Rightarrow$ : logically implies

$\Leftrightarrow$ : logically equivalent

1. Modus Ponens  $P \rightarrow Q$ $P$ $\Rightarrow Q$	2. Modus Tollens  $P \rightarrow Q$ $\neg Q$ $\Rightarrow \neg P$	3. Affirming the Consequent  $P \rightarrow Q$ $Q$ $\Rightarrow P$ (invalid!)	4. Denying the Antecedent  $P \rightarrow Q$ $\neg P$ $\Rightarrow \neg Q$ (invalid!)
5. Disjunctive Syllogism  $P \vee Q$ $\neg P$ $\Rightarrow Q$	6. Hypothetical Syllogism  $P \rightarrow Q$ $Q \rightarrow R$ $\Rightarrow P \rightarrow R$	7. Contraposition (Transposition)  $P \rightarrow Q \Leftrightarrow \neg Q \rightarrow \neg P$	8. Implication  $P \rightarrow Q \Leftrightarrow \neg P \vee Q$
9. DeMorgan's Laws  $\neg(P \wedge Q) \Leftrightarrow \neg P \vee \neg Q$ $\neg(P \vee Q) \Leftrightarrow \neg P \wedge \neg Q$	10. Proof by Cases  $P \vee Q$ Assuming P leads to R Assuming Q leads to R $\Rightarrow R$	11. Proof by Contradiction  Assuming P leads to $\perp$ $\Rightarrow \neg P$	12. Conditional Proof  Assuming P leads to Q $\Rightarrow P \rightarrow Q$